



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/606,708	06/26/2003	Douglas M. Beall	SP02-146	5076
22928	7590	03/25/2005	EXAMINER	
CORNING INCORPORATED			GREENE, JASON M	
SP-TI-3-1			ART UNIT	PAPER NUMBER
CORNING, NY 14831			1724	

DATE MAILED: 03/25/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/606,708

Applicant(s)

BEALL ET AL.

Examiner

Jason M. Greene

Art Unit

1724

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☐ Responsive to communication(s) filed on ____.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-34 is/are pending in the application.
- 4a) Of the above claim(s) ____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) ____ is/are allowed.
- 6) ☒ Claim(s) 1-34 is/are rejected.
- 7) ☐ Claim(s) ____ is/are objected to.
- 8) ☐ Claim(s) ____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 26 June 2003 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. ____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|---|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. ____. |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date <u>6/03;11/03;10/04</u> . | 6) <input type="checkbox"/> Other: ____. |

L

DETAILED ACTION

Claim Rejections - 35 USC § 102

1. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(a) the invention was known or used by others in this country, or patented or described in a printed publication in this or a foreign country, before the invention thereof by the applicant for a patent.

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

2. Claims 1-3, 6-10, 11, 14, 15, 17 and 20 are rejected under 35 U.S.C. 102(a) and 102(e) as being anticipated by Beall et al. (U.S. Patent Application Publication 2002/0004445 A1). The reference qualifies as prior art since the inventive entity of the published application is different than the inventive entity of the instant application.

With regard to claims 1-3, 6-10, 17 and 20, Beall et al. discloses a ceramic filter for trapping and combusting diesel exhaust particulates comprising an end-plugged cordierite honeycomb structure, wherein the coefficient of thermal expansion over a range of 25-800 °C is $4 \times 10^{-7}/^{\circ}\text{C}$, a median pore diameter d_{50} is between 14 and 25 micrometers, the porosity is at least 47% by volume, a volumetric heat capacity of is

Art Unit: 1724

least $0.67 \text{ J cm}^{-3} \text{ K}^{-1}$ as measured at 500°C , a quantity $d_{50}/(d_{50}+d_{90})$ as related to pore size distribution is less than 0.70, and a soot loaded permeability factor S_f as defined by the equation $[d_{50}/(d_{50}+d_{90})]/[\%\text{porosity}/100]$ is less than 1.55 in page paragraphs 0023 to 0094.

Specifically, in Example D2 in Table D on pages 8 and 9, Beall et al. discloses a ceramic filter having a median pore size (d_{50}) of $22.5 \mu\text{m}$, a porosity of 52.1 percent, a total pore volume of $0.4143 \text{ cm}^3/\text{g}$, and the pore size distribution specified in the table. While the value of d_{90} is not expressly set forth, its value can be determined from the total pore volume and the pore size distribution. From the total pore volume, the pore volume at 90 percent mercury intrusion can be calculated to be $0.9 * 0.4143 \text{ cm}^3/\text{g} = 0.3729 \text{ cm}^3/\text{g}$. From the pore size distribution in Table D, the value of d_{90} can be seen to lie between $10 \mu\text{m}$ and $20 \mu\text{m}$. Assuming a linear relationship, the slope of the line relating cumulative pore volume to pore size can be calculated as:

$$\text{Slope} = [0.3956 \text{ cm}^3/\text{g} - 0.2612 \text{ cm}^3/\text{g}] / [10 \mu\text{m} - 20 \mu\text{m}] = -0.0134$$

Using this slope and one of the data points, the value of d_{90} can be calculated to be:

$$d_{90} = 10 \mu\text{m} + [0.3729 \text{ cm}^3/\text{g} - 0.3956 \text{ cm}^3/\text{g}] / -0.0134 = 11.69 \mu\text{m}$$

Substituting this value into the recited equation yields:

$$d_{50}/(d_{50}+d_{90}) = 22.5 \mu\text{m} / (22.5 \mu\text{m} + 11.69 \mu\text{m}) = 0.658, \text{ which is less than } 0.70.$$

Substituting this value into the recited equation for S_f yields:

$$S_f = 0.6215 / .521 = 1.19, \text{ which is less than } 1.55 \text{ and between } 0.83 \text{ and } 1.40.$$

With regard to claims 11, 14 and 15, substituting the specific values of the filter of

Art Unit: 1724

Example D2 into the recited equations yield:

$d_{90}/d_{50} = 11.69 \mu\text{m} / 22.5 \mu\text{m} = 0.52$, which is greater than 0.40; and

$(d_{50}-d_{90})/d_{50} = (22.5 \mu\text{m} - 11.69 \mu\text{m}) / 22.5 \mu\text{m} = 0.48$, which is less than 0.60 and less than 0.50.

3. Claims 1-6, 8, 9 and 11-18 are rejected under 35 U.S.C. 102(a) as being anticipated by Published International Application WO 02/41972 A1.

With regard to claims 1-4, 6, 8, 9, 17 and 18, WO 02/41972 A1 discloses a ceramic filter for trapping and combusting diesel exhaust particulates comprising an end-plugged cordierite honeycomb structure, wherein the coefficient of thermal expansion over a range of 25-800 °C is less than $10 \times 10^{-7}/^{\circ}\text{C}$, a median pore diameter d_{50} is between 16 and 25 micrometers, the porosity is 50-75% by volume, the pore size distribution is such that the volume of pores with a size of 10 μm is 15% or less of the total pore volume and the volume of pores with a size of 50 μm or larger is 10% or more of the total pore volume, a quantity $d_{50}/(d_{50}+d_{90})$ as related to pore size distribution is less than 0.70, and a soot loaded permeability factor S_f as defined by the equation $[d_{50}/(d_{50}+d_{90})]/[\% \text{porosity}/100]$ is less than 1.55, and as in page 6, line 10 to page 7, line 12 and Table 3 of the English language translation.

WO 02/41972 does not explicitly disclose the values of d_{90} or honeycomb filter satisfying the relationship for S_f recited in claim 1. However, the recited relationship is within the scope of the WO 02/41972 disclosure. Specifically, as noted above, WO

Art Unit: 1724

02/41972 teaches the volume of pores with a size of 10 μm being 15% or less of the total pore volume. Within this teaching is a volume of pores with a size of 10 μm being 10% or less of the total pore volume. Therefore, a $d_{90} = 10 \mu\text{m}$ is within the teaching of WO 02/41972. Thus substituting the values of $d_{90} = 10 \mu\text{m}$, $d_{50} = 16 \mu\text{m}$, and porosity = 50% into the recited equation, the following calculations can be performed:

$d_{50}/(d_{50}+d_{90}) = 16 \mu\text{m} / (16 \mu\text{m} + 10 \mu\text{m}) = 0.615$, which is less than 0.70 and less than 0.65.

$S_f = 0.615 / .50 = 1.23$, which is less than 1.55 and between 0.83 and 1.35.

With regard to claim 5, as noted above WO 02/41972 teaches the volume of pores with a size of 10 μm being 15% or less of the total pore volume. Therefore, WO 02/41972 includes embodiments wherein the value of d_{90} is larger than 10 μm . For example, if the volume of pores with a size of 10 μm is only 3% of the total pore volume then the value of d_{90} will clearly be greater than 10 μm . Therefore, assuming a d_{90} of 11 μm and median pore size of 16 μm , the value of $d_{50}/(d_{50}+d_{90})$ can be calculated to be = $16 \mu\text{m} / (16 \mu\text{m} + 11 \mu\text{m}) = 0.593$, which is less than 0.60.

With regard to claims 11-13, substituting the values of $d_{90} = 10 \mu\text{m}$ and $d_{50} = 16$ into the recited equation yields $d_{90} / d_{50} = 10\mu\text{m} / 16\mu\text{m} = 0.625$, which is greater than 0.40, 0.55 and 0.60.

With regard to claims 14-16, substituting the values of $d_{90} = 10 \mu\text{m}$ and $d_{50} = 16$

Art Unit: 1724

into the recited equation yields $(d_{50} - d_{90}) / d_{50} = (16\mu\text{m} - 10\mu\text{m}) / 16\mu\text{m} = 0.375$, which is less than 0.60, 0.50 and 0.40.

Claim Rejections - 35 USC § 103

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

5. Claims 18-22 are rejected under 35 U.S.C. 103(a) as being unpatentable over Beall et al. (U.S. Patent Application Publication 2002/0004445 A1).

With regard to claims 18 and 19, the claimed porosities of 50 and 55 percent are seen as lying within the prior art range for porosity of at least 47%. Therefore, a prima facie case of obviousness exists which must be overcome through a showing of unobvious or unexpected results.

With regard to claims 20 and 21, the claimed ranges for volumetric heat capacity of at least $0.76 \text{ J cm}^{-3} \text{ K}^{-1}$ and at least $0.85 \text{ J cm}^{-3} \text{ K}^{-1}$ as measured at 500°C are seen as lying within the prior art range for volumetric heat capacity of at least $0.67 \text{ J cm}^{-3} \text{ K}^{-1}$

Art Unit: 1724

as measured at 500 °C. Therefore, a prima facie case of obviousness exists which must be overcome through a showing of unobvious or unexpected results.

6. Claims 7 and 19 are rejected under 35 U.S.C. 103(a) as being unpatentable over Published International Application WO 02/41972 A1.

With regard to claim 7, the claimed range for coefficient of thermal expansion over a range of 25-800 °C of less than $5 \times 10^{-7}/^{\circ}\text{C}$ is seen as lying within the prior art range for the CTE of $10 \times 10^{-7}/^{\circ}\text{C}$ or lower. Therefore, a prima facie case of obviousness exists which must be overcome through a showing of unobvious or unexpected results.

With regard to claim 19, the claimed porosity of 55 percent is seen as lying within the prior art range for porosity of at least 47%. Therefore, a prima facie case of obviousness exists which must be overcome through a showing of unobvious or unexpected results.

7. Claims 23, 24 and 30-34 are rejected under 35 U.S.C. 103(a) as being unpatentable over Merkel in view of Beall et al. (U.S. Patent Application Publication 2002/0004445 A1) or Published International Application WO 02/41972 A1.

With regard to claims 23, 33 and 34, Merkel discloses a method for fabricating a wall-flow filter comprising forming a batch of raw materials comprising magnesium

Art Unit: 1724

oxide, alumina, and silica raw materials in combination with extrusion aids comprising 3 percent by weight methylcellulose as binder, 0.5-1.0 percent by weight sodium stearate as lubricant, plasticizing and shaping the batch, wherein shaping is done through an extrusion die to form a green honeycomb body having an inlet end, an outlet end, and a multiplicity of cells extending from the inlet end to the outlet end, drying and firing the green honeycomb body at a rate of 15-100 °C/hr to a maximum temperature of 1405-1430 °C, with a hold of 6-25 hrs. to form a structure which is predominately of a phase approximating the stoichiometry of $\text{Mg}_2\text{Al}_4\text{Si}_5\text{O}_{18}$ (cordierite) and has a coefficient of thermal expansion over a range of 25-800 °C of $6 \times 10^{-7}/^\circ\text{C}$, and plugging a first portion of cells at the inlet end, and a second portion of cells at the outlet end such that each cell is plugged at only one end in col. 1, line 55 to col. 8, line 62. Specifically, Merkel discloses the green honeycomb body being fired by heating to a maximum temperature of 1410 °C at a rate of 25 °C/hr with a hold of 8 hrs in Example 1 in Table 2.

Merkel does not disclose the honeycomb exhibiting a pore size distribution such that $d_{50}/(d_{50}+d_{90})$ is less than 0.70 or the soot loaded permeability factor is less than 1.55.

As noted above, Beall et al. (U.S. Patent Application Publication 2002/0004445 A1) and Published International Application WO 02/41972 A1 teach forming similar honeycomb structures satisfying the recited pore size distribution properties.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to incorporate the final pore structures of the filters of Beall et al. and WO 02/41972 A1 into the method of Merkel to produce honeycomb filters having

Art Unit: 1724

high volumetric heat capacity and a low pressure drop across the length of the filters, as taught by Beall et al. in paragraph 0015.

With regard to claim 24, Merkel discloses the batch further including spinel having a stoichiometry of MgAl_2O_4 in col. 2, lines 62-63.

With regard to claims 30-32, Merkel discloses the magnesium oxide being supplied by magnesium oxide, the alumina being supplied by aluminum oxide or boehmite, and the silica being supplied by fused silica.

8. Claims 25-29 are rejected under 35 U.S.C. 103(a) as being unpatentable over Merkel, Beall et al. and WO 02/41972 A1 as applied against claim 23 above, and further in view of Hamaguchi et al.

Merkel does not disclose the batch further including a pore former having a median particle diameter of 3-140 micrometers.

Hamaguchi et al. discloses a similar method of making a filter wherein the batch includes a graphite pore former having a median particle diameter of 40 micrometers in col. 3, lines 65-68 and Table 1.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to incorporate the graphite pore former of Hamaguchi et al. into the method of Merkel to allow the porosity of the filter to be adjusted, as suggested by Hamaguchi et al. in col. 3, lines 65-68.


Conclusion

9. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Jason M. Greene whose telephone number is (571) 272-1157. The examiner can normally be reached on Monday - Friday (9:00 AM to 5:30 PM).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Duane Smith can be reached on (571) 272-1166. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Jason M. Greene
Examiner
Art Unit 1724


3/18/05

jmg
March 18, 2005